

What if the Hand Piece Spring Disassembles During Robotic Radical Prostatectomy?

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ABSTRACT

Background and Objectives: Robot-assisted laparoscopic radical prostatectomy (RALRP) is successfully being performed for treating prostate cancer (PCa). However, instrumentation failure associated with robotic procedures represents a unique new problem.

Methods: We report the successful completion of RALRP in spite of a disassembled hand piece spring during the procedure. A PubMed/Medline search was made concerning robotic malfunction and robot-assisted laparoscopic radical prostatectomy to discuss our experience.

Results: We performed RALRP in a 60-year-old male patient with localized PCa. During the procedure, the spring of the hand piece disassembled, and we were not able to reassemble it. We completed the procedure successfully however without fixing the disassembled hand piece spring. We were able to grasp tissue and needles when we brought our fingers together. The only movement we needed to do was to move fingers apart to release tissue or needles caught by robotic instrument.

Conclusion: Although malfunction risk related to the da Vinci Surgical System seems to be very low, it might still occur. Sometimes, simple maneuvers may compensate for the failed function as occurred in our case. However, patients should be informed before the operation about the possibility of converting their procedure to laparoscopic or open due to robotic malfunction.

Key Words: Da Vinci-S robot, Malfunction, Masterpiece, Spring, Radical prostatectomy.

INTRODUCTION

Prostate cancer (PCa) is the most common solid neoplasm in Europe and is currently the second most common cause of cancer death in men. It is surgically treated with some types of radical prostatectomy.^{1,2}

Minimally invasive prostatectomies are increasingly being used in urological practice, and robot-assisted laparoscopic radical prostatectomy (RALRP) has rapidly advanced and has become established as a frontline management modality for clinically localized PCa.³ Although robotic surgery is a new technology, instrumentation failure associated with robotic procedures represents a new and unique problem in urologic surgery.

Herein, we report how we managed to successfully complete a case of RALRP in spite of a disassembled hand piece spring during the procedure.

CASE REPORT

A 60-year-old male was referred to our outpatient clinic with lower urinary tract symptoms. His serum prostate-specific antigen (PSA) level was 5.7ng/mL. Digital rectal examination revealed a hard and indurated left prostatic lobe. Transrectal ultrasound (TRUS) demonstrated a 49.2-cc prostate, and TRUS-guided 12-core prostate biopsy revealed prostatic adenocarcinoma with a Gleason score of 6 (3+3), which was detected in 2 cores of the left prostatic lobe.

The treatment options were discussed with the patient, and he favored RALRP. His body mass index (BMI) was 30.1kg/m², and his American Association of Anesthesiologists (ASA) Score was 2. We performed a bilateral nerve-sparing RALRP, and console time was 180 minutes with an estimated blood loss of 100mL. During the procedure, the spring of the right hand piece suddenly disassembled and fell off (**Figure 1**). We found it on the floor and tried to reassemble it by ourselves but failed to fix it. Nonetheless, we were able to complete the procedure successfully without fixing the disassembled hand piece spring. We were able to catch tissue and needles when we brought our fingers together. As we understood that the function of the spring in the hand piece was to push fingers apart

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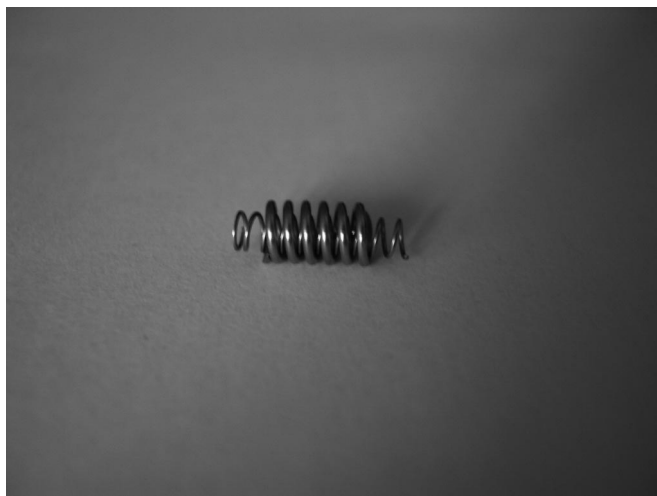


Figure 1. Disassembled hand piece spring of the Da Vinci-S robot.

and automatically release what have been grasped by the robotic instrument, the only additional movement we needed to do was to move fingers apart to release tissues or needles caught by the robotic instrument. We immediately informed the manufacturer, and the spring was fixed by the manufacturer's technician the following day.

Postoperative course of the patient was uneventful, the lodge drain was removed on the third postoperative day, and the patient was discharged the following day from the hospital. A cystography was performed in the first postoperative week following RALRP, and there was no urine leakage. Therefore, we removed the urethral catheter. On his 1-month follow-up, the patient was fully continent with a serum PSA of 0.01ng/mL. Pathology of the surgical specimen revealed prostatic adenocarcinoma located in the left lobe with a Gleason score of 6 without any extracapsular extension. Surgical margins were negative, and there was no seminal vesicle or vas deferens invasion for which a pT2a stage was assigned.

We have been using the da Vinci-S 4-arm surgical system (Intuitive Surgical, Sunnyvale, CA) since March 2009 at our institution and until now we have performed 70 RALRP cases. Apart from the malfunction described above, we have experienced an additional failure. A nonrecoverable fault occurred in the system during performance of another RALRP the reason for which could not be determined. As we shut down and restarted the system, we did not encounter any other problems and completed the case uneventfully.

DISCUSSION

In the last few years, radical prostatectomy has become the most commonly performed robotic-assisted surgical procedure, particularly in the United States, and RALRP might become the new gold standard for the surgical treatment of PCa.³ Three-dimensional optical magnification, dexterity in motion, and the ability to perform tremor-free movements are some of the major advantages of robot-assisted surgery.³ On the other hand, in addition to cost,⁴ probable robotic equipment malfunction during robotic surgery seems to be the major concerns of this high technology surgery.⁴⁻⁹

Between March 2009 and January 2010, we performed 70 RALRP by using the da Vinci-S 4-arm surgical system (Intuitive Surgical, Sunnyvale, CA), and we experienced 2 malfunctions (**Table 1**). A nonrecoverable fault in the system that resolved on its own following shutting down and restarting of the system. Others also reported similar system errors in their series.^{8,9} Following an English literature search using PubMed/Medline regarding robotic malfunction and robot-assisted laparoscopic radical prostatectomy, we reviewed all of the published reports related to these subjects (Table 1). Most of the robotic malfunctions reported in the published literature seem to be related to setup joint, robotic arms, power, monitor, camera, optics, hand piece, console, software, and the system itself.⁵⁻⁹

Malfunctions of the hand piece of the master control have also been reported related to the da Vinci surgical system.^{5,9,10} (Table 1). Ham et al¹⁰ experienced a disassembled surgeon's console hand piece, because of a loose screw during performance of RALRP. They reassembled it according to telephone guidance from the manufacturer's technician and successfully completed their procedure.¹⁰ They stated that this was their 26th procedure with the da Vinci robotic system.¹⁰ Similarly, malfunction of the hand piece (disassembled spring) occurred only once in the first 30 cases in our experience, and we were also able to complete the procedure successfully without fixing the disassembled hand piece spring. We understood that the function of the spring in the hand piece is to push the fingers apart and automatically release what has been grasped by the robotic instrument, so we did it manually. When we needed to release tissue or needles, we pushed our fingers apart and released them actively. The console surgeon controls the robotic arms with the hand piece of the master control. We used all 4 arms of the robot actively during performance of RALRP. Because the

Table 1.
Reported Etiology of the Malfunctions of the da Vinci Surgical System (Intuitive Surgical, Sunnyvale, CA) in the Literature

Reference	RALRP ^a Malfunction		Type of Malfunction (n)									
	n	n (%)	Setup joint	Robotic arm	Power error	Monocular monitor loss	Camera	Optical	Hand piece, masters, console	Software incompatibility	System error	Unknown
5	350	9 (2.6)	2	2	1	1	1	–	1	1	–	–
6	130	6 (4.6)	2	1	1	1	–	–	–	1	–	–
7	>700	4 (0.6)	–	–	1	–	–	3	–	–	–	–
8	1797	24 (1.3) ^b	–	6	1	–	2	–	5	–	10	–
9	8240	41 (0.5) ^c	–	14	6	–	–	14	4	–	–	3
Current Series	70	2 (2.9)	–	–	–	–	–	–	1	–	1	–

^aRALRP: Robot assisted laparoscopic radical prostatectomy.

^bOut of 1797 robotic surgical cases 762 were RALRP. Additionally, 19 cases (1.1%) of instrument malfunction were also reported in this series.

^cOf the 41 malfunctions, 34 (0.4%) were critical non-recoverable requiring the whole system to be shut down.

malfunction involved the right hand piece, which is also used to control the fourth arm of the surgical robot, we also did not use the fourth arm.

When disassembly of the handpiece in the console occurs, tissues grasped with the instrument are not automatically released as compression of the handpiece is discontinued. But instead, rings in the handpiece should be pulled apart actively to release the grasped tissues. Since we have repeated this maneuver many times, we know it is reproducible and reliable to continue and finish the surgery.

Other reported malfunctions and their types are summarized on Table 1. According to the literature, if a malfunction is detected and can not be fixed before anesthesia induction, the surgery is generally cancelled and rescheduled.^{5,6,8} Due to malfunctions that occur intraoperatively, some surgeons had to convert their procedures to either a conventional laparoscopic approach or an open surgical approach.^{5,6,8} Borden et al⁵ had to convert 3 cases (0.9%) out of 350 RALRP due to robotic malfunction. Kozłowski et al⁶ converted 2 cases (1.5%) out of 130 RALRP due to robotic malfunction. On the other hand, in a series of 1797 RALRP procedures, Kim et al converted only 3 cases (0.17%),⁸ whereas Zorn et al⁷ converted none in their series of >700 cases. Lavery et al⁹ suggested that the most frequently malfunctioning parts of the robot are the robotic arms and the optical system.

CONCLUSION

Although malfunction risk related to the da Vinci surgical system seems to be very low, patients should be informed before the operation about the possibility of the need to convert their procedures to either laparoscopic or open due to robotic malfunction.

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